Data Immersion

Exercise 5.6

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Time Series Analysis & Forecasting

1.

Create a time series using the instructions provided in the Exercise.

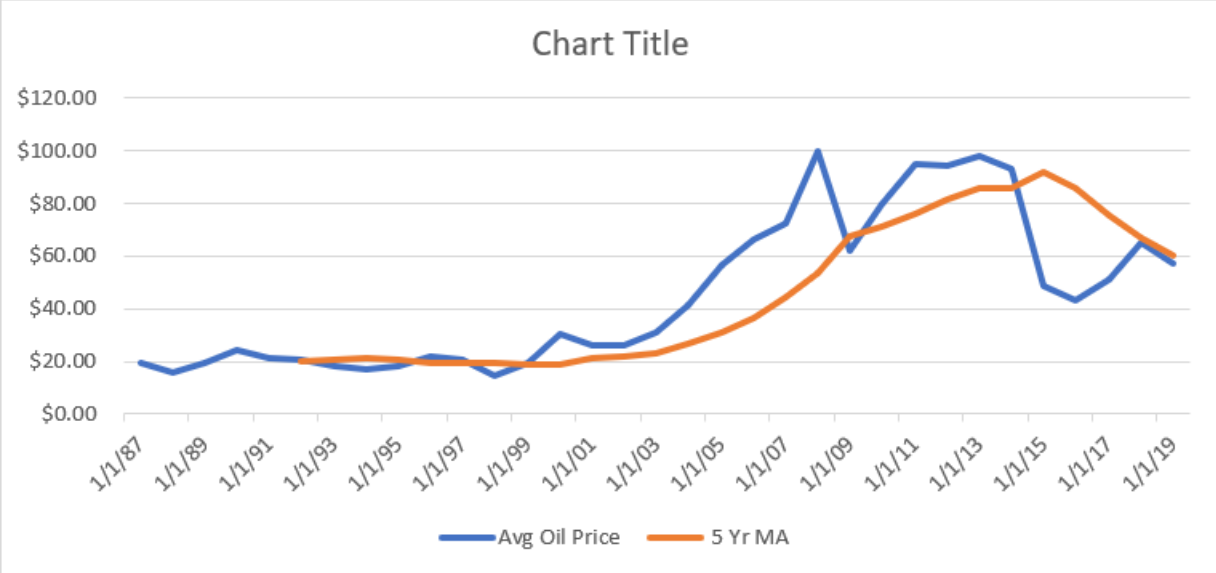
2.

Observe the pattern of the line in your time series and answer the following questions:

- **What characteristics does the pattern display (e.g., seasonality, stationarity)? Write a short paragraph to explain your answer.**
  - ◊ The time series created shows seasonality and a non-stationary pattern of incoming growth. The monthly revenue peaks in December, then drops in January. Revenue between January and December varies. Sales steadily rise over time meaning they're non-stationary, while sales fluctuate seasonally showing seasonality.
- **What advice might you give your client based on this time series. Why?**
  - ◊ I would advise having more stock available for the months of December and November to account for potential early sales. Conduct an analysis of what sales best during those times. Do an analysis on what sells best in January and lower selling months so they can prioritize what would still be sold during the low revenue months. Allow sales and necessity dictate the business needs from February through November.

3.

Create a simple moving average using the instructions in the Exercise.



4.

Observe the pattern/trend of the oil price line in relation to the fiver-year moving average line and answer the following questions:

- **Is there a certain characteristic to the pattern and trend? Make sure to provide a short explanation for your answer.**
  - ◊ Oil prices were constant from 1987 to 1998 and began to rise from 1999 to 2008 and fluctuated after 2008 showing a substantial decrease in 2008 and 2014. Though there isn't a repeating pattern, the data does show a non-stationary time series.
- **Explain how the moving average affects oil price volatility and how it makes forecasting easier.**
  - ◊ Because historical events can cause fluctuation in oil prices, a moving average provides a more trustworthy indication of oil prices. The smoothing effect reduces the impact of short-term volatility and provides a clearer understanding of the overall price trend. The moving average shows a strong downward trend towards closer years predicting that prices will continue to drop in the coming years.

5.

This Exercise mainly looked at non-stationary time series. Briefly explain why you might convert a non-stationary time series into a stationary time series before applying a forecasting model. (If you need help answering this question, check out the Resources above.)

Because non-stationary time series lack a clear pattern and have frequent changes between mean and variance with time, it can make forecasting show an inaccurate reading. To have a more effective forecast, it's crucial to assume stationarity in data.

By removing seasonality, we can create a model that is not reliant on time, which would allow for an easier trend. Stationary time series are easier to forecast because of their regular nature and reduced variations. While non-stationary time series often show unpredictable conditions, making predictions more challenging.

Statistical modelling methods require the time series to be stationary to be most effective. This helps minimize the impact of trends, seasonality, and other time-dependent factors.

6.

There are lots of other forecasting models, such as the Autoregressive Integrated Moving Average (ARIMA) model, which you'll have an opportunity to explore using Python in Achievement 6.

- **Do some research on the ARIMA model and one other model not covered in this Exercise, Facebook Prophet is one example that's become popular in recent years.**
- **Imagine you have to explain these models to a colleague who's unfamiliar with them. Write two short paragraphs (1 for each model) without going into the technical details. Include links to the resources you found during research.**
  - ◊ The ARIMA mode is used in statistics and econometrics to measure events that happen over a period. It is used to understand past data or predict future data in a series. ARIMA has two prominent methods of time series prediction (univariate and multivariate).
    Univariate uses only the previous values in the time series to predict future values.
    Multivariate also uses external variables in addition to the series of values to create the forecast.
    ARIMA can be used in any nonseasonal series of numbers that exhibits patterns and is not a series of random events.
  - ◊ What Is ARIMA Modeling? (mastersindatascience.org)
  - ◊ The Facebook Prophet is a forecasting procedure implanted in R and Python. The Prophet is a procedure for forecasting time series data based on an additive model where non-linear trends are fit with yearly, weekly, and daily seasonality, plug holiday effects. This works best with time series that have strong seasonal effects and several seasons of historical data. Prophet is an open-source software released by Facebooks Core Data Science team.
  - ◊ Prophet | Forecasting at scale. (facebook.github.io)